Beauty is Truth: Multi-sensory input and the challenge of designing aesthetically pleasing digital resources.

Introduction

[1]The relationship between digital and physical environments and objects is complex, and is not yet sufficiently understood, especially when it concerns questions of aesthetic appreciation and enjoyment. Recent studies have suggested that there is little difference in the time that users spend interrogating digital and physical objects in museums, and that digital objects can be just as engaging and interesting as physical ones (Hogsden and Poulter, 2012). Yet users only report a sense of awe, wonder and delight when encountering physical, rather than digital collections (Varnalis-Weigle, 2016; Cameron, 2007) This almost magical experience of visiting a physical heritage site is not replaced by being able to use a digital surrogate, however much more information we may be able to derive from it. The more we digitise the more demand there is for the 'real'. User behaviour has not changed to favour digital environments over physical ones, as was once expected.

For example, Durham University has begun to digitise the Priory Library, one of the very few complete monastic libraries in the world. Had this happened twenty years ago, the assumption might have been made that digitisation would preserve the originals from possible damage or decay associated with use. Yet now we are aware that although the digital resource may be used all over the world, improved knowledge of its remarkable contents is likely to mean that more people will want to visit Durham to use the physical collection. It is therefore fortunate that physical library space has also

been renovated, and will allow users to interrogate a digital resource, while also being immersed in the physical reality of an intact medieval library.

As this example shows, users continue to populate physical information spaces as well as digital ones. This may be due, in part, to problems with the design of digital systems for use in cultural heritage and the humanities that have proved to be unexpectedly difficult to solve. For example: why is it difficult to locate ourselves and understand the extent and shape of digital information resources? Why is digital serendipity still so unusual? Why do users persist in making notes on paper rather than using digital annotation systems? Why do we like to visit and work in a library, and browse open stacks, even though we could access digital information remotely? Why do we still love printed books, but feel little affection for digital e-readers? Why are vinyl records so popular? Why is the experience of visiting a museum still relatively unaffected by digital interaction?

The answer is very emphatically not because users are luddites, ill informed, badly trained or stupid. I will argue below that the reasons these problems persist may be due to the very complex relationship between physical and digital information, and information resources. I will discuss the importance of spatial orientation, memory, pleasure and multi-sensory input, especially touch, in making sense of, and connections between physical and digital information. I will also argue that, in this context, we have much to learn from the designers of early printed books and libraries, such as the Priory Library and that of John Cosin, a seventeenth-century bishop of Durham, who founded the little-known marvel that was a pioneering public library in the

North of England, and still exists, intact; one of the collections of Durham University library.

John Cosin was Bishop of Durham during a turbulent period of religious history in England. He became Bishop immediately after the restoration of the monarchy in 1660 after the English Civil war and commonwealth period. He had been exiled in France for many years, during which his religious and political views changed, a fact reflected in the books he added to an already extensive collection (Dubois, 1982). On his return he established a library, for public use (Doyle, 1991). Sadly its pioneering design and remarkable contents have been largely ignored, even by book historians.[2] Yet, as I will show, consideration of the construction of Cosin's library provides a helpful framework within which to consider the problems of digital design presented above.

The use of physical library spaces and resources

Cosin's books remain in the building that he designed for them, but, sadly, both are now too delicate and valuable to be used regularly by readers. Nevertheless, other Durham University library buildings are very intensively used. Our experience is far from unusual. Although the use of digital resources, in particular e-books, is increasing in academic libraries across the UK, physical visits are also increasing (SCONUL, 2015). Far from being turned into social isolates, as the Follett report predicted in 1993 (UKOLN, 1993), students seem keener than ever to use libraries as workspaces. Indeed, in Durham, complaints about lack of study space are the most common item of feedback in the Student Union Study Space Survey

(Henderson, 2016), and library occupation rates have gone up 25% since 2011. The Russell Group of research-intensive UK universities also saw an 11% increase over the same period and a total of 44 million visits. In a big city, this might seem easily explicable: students have long commutes and might choose to work in the library between lectures because they do not have time to go home. However, Durham is a tiny city of about 50,000 inhabitants, and most students live within twenty minutes walk of the library. Yet the university library emerged from the study spaces survey as by far the most popular place in the university in which to work.

This may be due to students' appreciation of the library as the so-called 'third space', neither a domestic space nor a workplace (Latimer, 2011). They can work with friends, but also apart from them; they can socialise in the café or return to the stacks to work in silence. However, the reason given by 75% of students in our survey who prefer to work in the library is the highly intangible idea of 'atmosphere' (only 54% of students said it was because of the availability of learning materials and less than a third mentioned anything to do with proximity to where they live). The library may be described as 'inspiring' or 'cozy', but overall, it feels like the best place to study. Several other recent studies carried out in a variety of academic libraries report similar findings (Abbasi, et al., 2014; Andrews et al., 2015 and May and Swabey, 2015).

A library is not simply a pleasant workspace, however: even in the digital age it is a book container or it is nothing. The least-used area of the Durham University library is the graduate student hub, a computer-enabled

workroom with no books. As Andrews and Wright (2015) found, students thought that a study space without books ‘wasn’t really a library’ but felt more like a café.

Such an effect is not limited to the preferences of students; last year I was fortunate enough to be on a panel at the Edinburgh Book festival with Anthony Marx, the director of the New York Public Library, and Francine Houben, the architect of one of the most notable contemporary library buildings in the UK: The Library of Birmingham. Both of them stressed the importance of the grandeur and beauty of libraries in enhancing the readers' experience. Marx reported that many of the users of the NYPL’s iconic reading room bring their own laptop and do not use any of the library’s resources, either physical or digital. Yet they want to be in that remarkable space, because it is conducive to their work, or just a pleasant place in which to read. Such an ambiance is the result of centuries of careful design of libraries as spaces for both information and people.

Houben stressed the importance of playful, attractive design in creating an environment for a varied group of readers in the Library of Birmingham, describing her use of colour, pattern and light conducting and reflective materials as a physical backdrop to the activities taking place. Despite his advanced age and poor health Cosin’s letters show that he also designed his library carefully. Its construction made an important political statement about the power of the restored English church, and its creator’s own erudition, and ability to control information and its dissemination (Green, 2016: ch. 5). It was one of the first libraries in the north of England to be designed for public use-

of course by the kind of educated person who could read and understand such books. Carnegie's universal plan for the hundreds of libraries he funded in the nineteenth century was intended to entice readers in but separate noisy children from serious readers in the reference room (Black and Pepper, 2012).

Despite the greater use of digital resources library designers remain just as conscious of the effect of the library space, and its ambiance, on their readers, and this is clearly something that readers appreciate (Niegaard, 2011). Technology may have freed the librarian from tedious automated tasks, and turned him/her from the guardian of the central desk, surveilling readers and protecting books, to the friendly provider of advice about resources whether digital or physical (Dahlkild, 2011). Spaces may have become more fluid, with many different zones for individual and group work, quiet study, and socializing. Yet, as with the Carnegie plan, many new libraries are designed deliberately to lead readers into and through the space, to help them at once enjoy it and navigate its content (Latimer, 2011).

Physical space and information navigation

The library is not the only place in which our students like to work. Many of them have a small repertoire of study spaces, including their house, a cafe or the department. They employ a complex repertoire of information delivery and analysis devices in the library, each chosen for its usefulness for a particular task. Individuals may use a laptop, perhaps to access digital journals or learning materials, as well as checking social media on a phone, perhaps using a tablet as well. Yet they also refer to printed books, consult folders of

handwritten notes, carefully annotated in colour or with post-it notes. To find information, they may use the digital catalogue or scan the books on the shelf.

Visualising the extent of a collection

As Buchanan et al. (2015) suggest, this behaviour is evidence of neither luddism nor digital obsession, but an almost instinctive awareness of the affordances of devices for information delivery and the spaces in which they might be used. Such affordances, often taken for granted in physical information spaces, can be surprisingly difficult to model in digital ones. One such affordance is the ability easily to understand the extent of a collection. This has long been of concern to researchers in Human Computer Interaction, yet it remains very far from being solved (See for example Greene et al. 2000; Dillon, 2000; Rapp et al., 2003; Makri et al. 2007).

For most users, the 3,600 books in Cosin's library, when arranged in its purpose-built room would, have constituted a very large collection. But its arrangement on open shelves would have meant they could quickly construct a sense of its scale, and helped them understand the relationship between the information they had found, and that which remained to be found, or read. The size of the pile of books read, and to be read, and the ability to turn the pages of a book helped readers, then as now, to keep track of their progress through the system.

But the problem of how to help users understand the extent of a collection remains surprisingly difficult in digital systems, and is important to humanities scholars, especially those expert in a subject. Typically these users know a great deal about the topic that they are researching, and may

have read many of the available texts, thus they must be able easily to understand what is new in any system, and how the quantity of material still to be consulted compares to that they already know (Bates, 1996). This ensures that they do not miss a vital piece of information that might affect the integrity of their argument, and are able to check that planned research is innovative. Users have become accustomed to how databases such as Google Scholar, Scopus, or Web of Knowledge operate, and can learn to use recursive cited reference searchers. But the lack of information about the extent of the system and how it compares to our personal knowledge bank, first noted by Bates twenty years ago, means that digital systems are still not optimally designed for humanities users.

The ability to visualise the progress we are making when reading a digital text is an analogous problem. Designers of ebooks have provided different types of navigation aids, to help users understand how far they have progressed with a book, but few users seem to like, use, or understand them, and turning ersatz digital pages is universally disliked. Nothing we can find in a digital system seems as simple and reassuring as the instant feedback provided by the sight and heft of a thick wedge of pages already read or a book stack where we recognise most of the titles, and can quickly distinguish from this the ones that we don't.

Navigating the collection

The problem of how to navigate a large digital collection has also been very hard to solve, yet it is something users have grown to take for granted in the case of physical libraries. This was not always the case, and demonstrates

the innovative nature of Cosin's library. Medieval libraries such as the Priory Library, in Durham were often organised in carrels, perhaps because they were the medieval analogue of the modern hybrid workspace described above. The monks probably knew the space well, and used its physicality to help them find familiar, useful resources. The horseshoe shaped carrel would have helped to minimise distraction for the monk working in it, but would also make it easy for him to see the relatively small number of texts it contained. Classification systems in medieval libraries were rare or non-existent, so the ability to recall what a book looked like, and where it was kept would have been vital to the usability of the collection (Gameson, 2014).

However, Cosin had a different vision for the scope and potential use of his library. Instead of being a personal workspace, his library was to be an information resource that others, who may have been unfamiliar with the contents, would consult or visit. As a result they would not have time to learn the private geography of the book space, but would need to be able quickly to scan the contents of the library. Users would need finding aids, and visual clues to allow them to understand the scope of what must have seemed a dauntingly large collection, much of which might be unfamiliar. Cosin therefore adopted the most innovative technique then available: open shelves fixed around the walls of the room and a workspace in the middle. This technique had originated in continental Europe around the turn of the seventeenth century, partly as a response to contemporary advances in information technology: printed books were now more plentiful, cheaper, and smaller. Old library buildings and interface technologies (shelving and book desks) were

no longer adequate for what we would now call information visualisation, storage and retrieval. These techniques were pioneered by the Biblioteca Ambrosiana and the Bibliotheque Mazarine, which Cosin visited while in exile; he would also have read the text on library building and organisation, written by its librarian, Gabriel de Naudé (1627). However, such wall-hung libraries were extremely rare in England, the only example pre-Cosin being the Bodleian Library in Oxford. However, at the Bodleian the books were chained or kept in a gallery with limited access, and benches were fixed in front of the open cases, which made browsing far more difficult than in Durham (Newman, 2014). To appreciate how radical Cosin's design was, it is important to remember that Clerkenwell Library, the first public library in the UK to allow users to browse open shelves did so in 1894, and the practice only became usual in the early twentieth century (Black and Pepper, 2012).

Open stacks have another benefit for users. It has become a commonplace in the literature on digital resource design to state that users wish to browse digital collections and make serendipitous discoveries as they are accustomed to doing on open stacks in libraries (McKay et al. 2015). This is made possible partly by the library classification system: a fact not often understood by users. There have been numerous interesting studies about how to simulate serendipity in digital systems (for example Foster and Ford (2003); Quan-Haase and Martin (2013); Makri and Blandford (2012) and Makri et al. (2014)) but so far we have not succeeded in designing anything to facilitate serendipity in digital space that is as effective as the open stack library system.

Cosin also introduced another innovative navigation feature, which relies on our ability to make sense of physical spaces with visual metaphors and guides. Above each bookcase are portraits of the authors that were originally to be found there, labeled with their names. These may have been inspired by similar designs at the Bodleian; but Cosin's use of images was functional as well as decorative (although, even at the time, they were not thought to be especially attractive (Green, 2016: p.91)). They are an aid to information retrieval, performing a mnemonic function that was innovative at the time, and remains very unusual.

The wish to use physical space and colour as navigational aids is not merely a historical practice however. In her study of art historians' personal collections, Kamposiori (2016, p. 206) found that participants often used index cards, box files and field notebooks to organise their research, in addition to digital tools such as database management software.

Physical storage of printed materials proved just as, or even more, effective, as a means to navigate and make sense of a collection; the layout of the room and the colours used to mark different kinds of materials acted as navigational aids. This is not surprising. Spatial memory is important to humanities scholars in making sense of physical information collections, and the lack of spatial clues is problematic in the navigation of digital ones, as several studies conducted in the early years of digital libraries demonstrated (Brilliant, 1988; Case 1991a, Case 1991b; Reed, 1992). Although many attempts to develop such aids in digital space have been made since then, (for example, those discussed by Greene et al. 2000) very few information

systems make effective use of space or colour to aid navigation. Yet users find both highly effective when using a library, or reading a book, hence the post-its and highlighters used by our students, or the arrangement of the scholars' offices above (Makri, et, al. 2007).

As with Cosin's author portraits, so physical images can have both a utilitarian and aesthetic function for modern users of information. One participant described arranging a collage of images on a pin board placed above his/her computer (Kamposiori, p.178).

> So, I put up a billboard on top of my desk because I'm writing an essay on the gaze of the matriarch and this is why you see so many pictures. What I did was to print out all these pictures, so I can just stare [at] them all and get inspiration. If the stimulus you're facing is constant, you can't escape it. [Participant 12] (Kamposiori, 2016, p.178)

The participant also draws attention to the permanence of the images on the pinboard display, which contrasts with the ephemeral nature of digital resources such as Google image search. This displays thumbnails that a user may scroll through, but there are few reports of users saving such digital assemblages as inspiration.

The aesthetics of information

It is important to recognise that users' experience of information spaces is driven not only by utility but aesthetic pleasure. The collage functions as a source of inspiration and a way of corralling ideas, but it is also a pleasure to look at. Users choose the NYPL reading room because of the beauty of the

space, its decoration and light. Students consider the Durham University library inspiring, and thus conducive to work. This would undoubtedly have pleased Cosin, who directed numerous building and renovation projects, and drew up plans for a new library at the University of Cambridge, which, sadly, was never built. For Cosin, the creation of beautiful spaces was an expression of humanity's devotion to God- an extremely controversial view at the time, which, despite the hardship of exile, he never abandoned. He was also aware of Vitruvian principles of architectural harmony, and owned an edition of Vitruvius' *De Architectura* (Green, 2016, ch.5).

This combination of beautiful design and effective function is also evident in many of the books in Cosin's library. The beautiful leather bindings and gold lettering served to advertise their status as valuable objects (Gwynn, 2011), but the design of the text itself could be just as significant. From early printed books to modern newspapers, type has been set and pages laid out to attract and hold the attention of readers. This not only enhances the meaning of the text, and contributes to its usability, but also to its intrinsic beauty (Evans, 1974: pp. 3-4). Just as library design leads users into and through information spaces, so variations in type sizes lead the eye to important words on a title page, causing the reader to wish to buy the book, or continue to read (Barker, 1977). Such effects were often due to close collaborations between authors and printers. As McKenzie (1981: p.112) showed, Congreve was very concerned with the printed layout of his plays, and worked so closely with his printer, Jacob Tonson, that he lived in the same house. Indeed the working relationship described by McKenzie seems almost to prefigure a digital

humanities collaboration between an academic and an alt-ac practitioner. Printers were not simply mechanics, but skilled artisans, with an eye for the nexus between physical appearance and usability.

Such a link between aesthetic appreciation and finding and evaluating information is something that we have neglected in the digital world. The phrase ‘user experience’ very seldom encompasses concepts such as pleasure, wonder, or the appreciation of the beauty of a digital information object. In neglecting such aspects in the digital world we lose a great deal that we know users value. A fascinating and highly influential study by Lindgaard et al. (2005) indicates that users of websites make up their minds about whether, very literally, they like the look of a site in a fraction of a second. This decision must be pre-cognitive and based on instinct about what is appealing. Yet information design is still dominated by measures of cognitive judgment, and neglects to ask about what users find pleasant, as opposed to efficient. Users are, however, already applying such judgments when making choices about physical and digital resources. For example, many readers still value the physical book, far beyond its utility as an information object. They are aware that they can access novels, for example, as e-books, but, as Dietz et al. (2015) show, users do not regard digital objects as pleasant to use, beautiful, or culturally valuable. All these qualities, as well as a level of love that sometimes approaches addiction, are vested in the physical book, which users repeatedly describe as ‘real’ books, with all the attendant implications for the esteem in which they hold digital versions. This is despite the fact that the typography, layout and paratext of such digital copies look almost exactly

the same displayed on an ebook reader as they do on the printed page (Deitz et al., 2014; Dietz et al. 2015).

Empirical studies of digital book design and the affective reactions they evoke are still relatively rare. However, a classic study of readers of physical text demonstrates a strong link between typography and aesthetic pleasure (Burt et al., 1955), although its methodology has since been questioned (Hartley et al., 1983). If we are willing to believe Burt's data, users reported an instinctive sense that a style of type 'just looks right'; it might even cause a strong emotional reaction, expressed in terms of a physical sensation - 'it makes me giddy to read it'. Sometimes readers went so far as to attribute active, almost human volition to a style of type. One reader thought that handwriting might be expected to express its creator's personality, but objected to the possibility that mechanical type might do so. 'Each is trying to express itself when it ought to be expressing the author's meaning'. It is intriguing that user reactions to styles of type were strongly driven by memory, for example of a book they had liked or disliked at school, or perhaps a typeface that reminded them of a text they were reading at a happy time in their life. It is clear from Burt's study that the participants felt strongly about the effect that the use of different typefaces had on their experience as readers. Dietz et al., (2015) findings confirm Burt's, in terms of intense emotional attachment to printed books expressed by users. Yet Dietz's work finds almost no evidence of pleasure in the use of, or affection for, digital resources. Even if the content is a much-loved novel, for example, the digital medium inspires no such emotion.

Citations and editions

This might be one of the reasons for another apparently insoluble problem in the use of digital resources. Much to the constant frustration and incomprehension of those who design digital resources and study their use, most users continue to cite the physical copy of a text, even if we know, or strongly suspect, that they have accessed it in digital form (Bulger, et al. 2011; Meyer et al. 2009) Meyer and Schroeder (2015: pp. 155-157) attribute this to the innate conservatism of humanities scholars. Yet, they argue throughout their book for the transformative power of digital resources on scholarship, including that in the humanities. This seems such a striking contradiction that there is surely something more fundamental at play than simple fear of change.

There is also mounting evidence that, despite the potential utility and complex functionality of digital editions, especially when they contain variant texts, users and editors persist in using several physical texts, despite their clunky, abbreviated, apparatus criticus (Porter, 2013). Porter shows that the use of digital editions has remained static since her earlier study in 2002, whereas that of digital journals and facsimiles has grown, as we would expect, given improvements in technology and resource availability. This has been attributed to laziness, Luddism, or a lack of understanding, on the part of more traditional scholars, of the promise of digital editions (Robinson, 2005; Porter, 2013; Van Zundert, 2016). This also seems unconvincing.

It is surely more likely that, whether in the case of citation, or use of editions, users are once again demonstrating a complex understanding of

affordances of physical and digital materials. Recent research suggests that such behaviour may be due to the complex interaction between sensory input, spatial memory, and pleasure. Fascinating work by Chatergee et al. (2009) in collaboration with UCL museums has shown that memory and emotion are strongly linked; both relate to the way in which complex sensory input is processed by the brain. Their studies show that handling an object from a museum evokes completely different responses in the brain from simply looking at it, and that this can have very positive therapeutic outcomes in a health context. This is because different parts of the brain are being used when we touch an object as well as looking at it.

It may seem perverse to the creator of a digital edition, but many users appear to find it more convenient to navigate and compare several different texts if they are spread out on a desk than to synchronise variants on a single screen. Perhaps, as Chatergee's work would suggest, this is because the act of touching objects, and organising materials on a surface, not only makes it possible to examine them visually but also evokes a different kind of sensory response than simply looking at a visual, digital display. Users may also, as Dietz et al.'s work shows, enjoy handling a physical object because of their affection and respect for its aesthetic qualities and cultural value. Thus the whole experience seems more rewarding than using a digital surrogate.

Reading, writing and listening

Using printed material may also make information easier to recall. As Mangen et al. (2013) show, school children recall information more effectively from printed texts rather than digital ones. Their study also stresses the importance

of the physical layout of a printed text in helping users to navigate and recall information. However, they, and other research they cite, examine single texts- one in a printed document another on a computer screen- rather than drawing conclusions about the wider environment and physical arrangement of texts. Such research is in its relative infancy. However, the more studies are carried out, the more it appears that the brain does not treat the physical and the digital as identical environments. This knowledge should have profound consequences for the future of information design. It is becoming clear that if we simply blame the user for their ignorance, rather than seeking to understand the complexity of and reasons for their choice of media, we will miss the chance to improve digital resources.

These findings may also help to advance our understanding of another unexpectedly difficult problem in digital user studies, that of annotation. For more than twenty years numerous groups in digital humanities and computer science have investigated the possibility of annotation of digital text and images, including INKE (http://www.inke.ca), Pliny (http://pliny.cch.kcl.ac.uk/) and the Open Annotation Collaboration (http://www.openannotation.org/) (Juola, 2008; Bradley, 2012). Yet however many technical teams work on the problem, and however many interesting digital solutions are offered, the majority of users continue to make use of the method used by Cosin himself; writing notes by hand, sometimes in the text of the book itself.

These annotations, especially his revisions of the prayer book, provide vital evidence for our understanding of the religious and political history of the post-restoration world. We are still able to use the physical material 350 years

after the annotations were created. Yet digital annotations may be easily lost as systems and standards change: this is a significant challenge for the digital preservation community (Bläsi, 2015). It may also be a reason for the persistence of physical annotation among users- problems of digital decay and the persistence of paper are relatively well understood by humanities users, especially those who access historical material.

Perhaps even more significantly, recent studies have suggested that different parts of the brain are activated when we write by hand, as opposed to typing; these areas are associated with memory, recall and learning. Writing by hand is a multi-sensory process involving areas of the brain that relate not only to sight but also to motor function and touch. Rather surprisingly, perhaps, it also calls upon the part of the brain responsible for sound, as we silently compose the words in our heads before writing them down. It is therefore qualitatively different from typing on a digital device (Mangen and Velay, 2010). Thus if users write notes or annotate text by hand, they are likely to remember it better (Mueller and Oppenheimer, 2014; Mangen et al., 2013). Once again, we begin to see that there is a link between touch, physical objects and spatial arrangement that is not present in digital annotation systems; this may be partly why they are not as well used as might have been expected.

Meanwhile the resurrection of vinyl as a format for music continues to gain pace, for reasons that are, in many ways, analogous to those that relate to the use of books. Users have not abandoned MP3 entirely, but are likely to use both, depending on context (Nokelainen and Dedehayir, 2015). Digital

recording techniques might be argued to produce a purer sound, and deal with high and low frequencies with less distortion, but yet it seems that many users perceive the sound of vinyl as different from MP3 or CD; perhaps warmer, less harsh, more human. They also feel attachment to and affection for the physical form of a record, and to their record library (Sarpong et al, 2016). Again, this is related to sensory input- not only the complexities of the perception of sound, but the ability to touch physical things, and very literally to place them in one's living space.

Museums and digital interpretation

Some of the most interesting recent uses of digital technologies in cultural heritage are those that augment the experience of visiting the museum or site, or enrich the nature of visitor engagement. At the Chateau de Falaise, in Normandy, visitors loan tablets, which use augmented reality 3D reconstructive technology to overlay an image of how the Chateau may once have looked onto the twenty-first century remains. This allows the present and possible past to flow into one another but also easily to be kept apart (de Sa Moreira and Lussan, 2013).

The QRator project, developed with UCL Museums, used fixed iPads to encourage visitors to engage with provocative questions posed by the curators (Ross et al. 2013). Many visitors turned their interactions with the questions into a hybrid social experience: they discussed their ideas and responses with others in digital space, and with friends or family visiting the museum with them. Despite the initial expectations of the digital design team and museum curators, very few visitors decided to use individual mobile

phones to access the QRator interface, whether inside the museum, or after the visit (Bailey-Ross et al., 2016). The iPads were placed in front of the cases that had inspired the questions, with plenty of circulation space around them, rather than, for example, a bank in the middle of the room. This allowed visitors to navigate the museum space, meet and discuss their ideas with others, and relate objects in the physical space to the content of the digital resource. They could touch the screen of the iPad and point to objects in the case, thus allowing as much sensory and social input into the experience of interaction with a digital resource as possible.

A third of museum users left comments on QRator; a huge increase from the tiny numbers who write in comments books (Bailey-Ross et al., 2016). Nevertheless, despite proof that the technology could work at the Museum of Brands and the Imperial War Museums, QRator, and other systems to facilitate interaction between visitors and curators have not yet been widely adopted. It seems unlikely that this is due to lack of knowledge; QRator was featured in the very widely read NMC Horizon Report: 2011 (http://www.nmc.org/pdf/2011-horizon-report-museum.pdf) and received a large amount of media coverage. Once again, we might look at questions of the aesthetic appreciation and cultural value of physical objects. Although studies of born digital museum objects suggest that users may find them as compelling as physical exhibits (Hogsden and Poulter, 2012), digital surrogates, however interesting the functionality, will never replace the centrality of the physical object, or work of art to the experience of visiting a museum (Gurian, 1999; Leinhardt and Crowley, 2002).

The QRator model could be seen as profoundly disruptive of models of knowledge and authority and design in museum spaces, however benignly they may be expressed. The role of the museum curator has, historically, been to explain the significance and importance of objects, and to arrange, display and label them according to this interpretation. Yet Qrator asks visitors to express their views rather than telling them what they should know. It may be for this reason, whether openly articulated or not, that museum professionals have been slow to adopt such systems. However well designed and tested a system may be, social factors relating to how we feel about the appropriate use of physical spaces and their cultural value may prove as important as purely technical ones.

This is a different model of professional and cultural practice than that adopted in libraries. Cosin selected books for their potential utility and to provide knowledge that might heal religious divisions of the time. Collection development has remained core to the profession of librarianship ever since: unless it is a copyright library, collections reflect decisions librarians take about what users should be reading, or not, in certain notable cases (McMenemy, 2008). But this process is less explicit than in a museum and thus almost imperceptible to users. There are no interpretive labels, summarising why a book, or collection of books, is regarded by the librarian as interesting or useful. The arrangement of a library is dictated by the classification system, whereas that of the museum is far more driven by curatorial choice, especially in the case of temporary exhibitions. It is possible the extensive engagement that librarians have therefore had with such

classification systems, latterly in digital form, may account for greater use of digital technology in libraries than in museums.

Multi sensory input

In previous work we argued that users preferred physical to digital information environments because it was surprisingly difficult to learn new digital information skills, or to translate complex information behaviour learned in a physical setting into a digital one (Makri et al. 2007). This study was conducted almost ten years ago, and since then digital reading devices and information resources of all kinds have become ubiquitous and easier to access; yet user behaviour has changed relatively little. There must, therefore, be another reason for such choices, and it appears to be very strongly correlated with questions of memory, spatial awareness, cultural appreciation and aesthetic pleasure.

This correlation is not surprising: memory, as Chatergee's work demonstrates, is strongly related to complex sensory input, as Proust knew very well. But in most cases digital resources appeal only to one sense at a time, usually the visual, or possibly the auditory, in the case of digitised music. Digital videos appeal to two senses at once, which could explain why they often form the centerpiece of internet memes; because they are more memorable than those digital resources that appeal singly to our eyes or our ears. But even in the case of digital video, the action occurs in two dimensions, and lacks the appeal of spatial orientation and experience. Despite attempts to integrate the digital with the physical, whether in cultural heritage sites or libraries, the digital environment alone cannot offer us a truly

multi-sensory experience. We cannot touch digital objects, although we might speculate that the popularity of tablets and touch-screen phones is because they bring another sense into play. It is also currently impossible to involve taste and smell- often so vital in the formation of memories- in digital interaction. Perhaps users do not feel a particular attachment to, or affection for, things digital because, as well as helping to form memories, our senses guide our emotional reaction to things and people. If sensory inputs are relatively simple, perhaps only involving sight or hearing, our reaction to them may be less profound. In effect our choices are driven by touch, both in the physical haptic sense of what is tactile (what we can touch), and in the metaphorical sense of what is moving (what touches us).

Discussion

The themes that emerge from these various problems and phenomena is the importance of physical space and place in understanding physical information resources, and of the importance of memory, multi-sensory input and affect in driving decisions about use. We must either accept the idea that some types of information environment can never be bettered in a digital sense, or take far more seriously the task of understanding the nexus between information and affect, such that we aim to design resources that are not only cognitively straightforward, but appeal to our more emotional reaction to information objects, and places that contain them. The digitised priory library will enable users to access the information easily, quickly and from anywhere in the world. As such, in common with all digital resources, it is the solution of convenience if physical resources cannot be accessed (in this case, when

users cannot travel to Durham to consult the originals). But can we hope to design for the gasp of wonder and intense sense of fascination and attraction that strikes a visitor when they walk through the door to the actual resource? Is it perhaps a vain endeavour?

If, as cognitive science is beginning to suggest, the brain processes information differently in physical and digital environments, we dismiss at our peril the possibility that the physical information environment is more suitable for some activities, especially when we have hardly begun to understand the reasons for this. We must take seriously the importance of physical space and colour as a way for users to orient themselves when they interact with information, whether physical or digital. Rather than wondering why users choose to work in a library, seem seldom to understand or make use of annotation systems, or devices that try to indicate how much of a text has been read, or a digital resource consulted, or those that allow the overlay of variants on a screen, perhaps we should simply accept that users are likely to want to do this physically instead. Why try to create an ever more complex ersatz notebook, when many users find a paper one more suitable for their work? There is a danger of technocratic arrogance if we assume that everything can be modeled digitally and thus improved.

We might do well to think carefully about the adaptability of the library as a space and as an organisation. Library designers have long understood that there is far more going on in their spaces than simply reading. Libraries are beautiful things, containing beautiful things; spaces for books, people, light and colour. They are flexible, effective information interfaces that allow

users to orient themselves in space, and comprehend how big a collection might be, whether that is a shelf, a room, or an entire building. The use of open shelves allows visual navigation, and serendipitous discovery. They provide social spaces- places for work and places away from work- where people can be together or apart or both, in neutral space, but one that has a reasonable level of calm and oversight of behavior, as opposed to the sometimes toxic digital spaces of social media. They are places where information can be touched, organized, and arranged by an individual.

In the early 1990s the digital library was often contrasted with the hybrid library. It is now taken for granted that all libraries are hybrid: they deliver digital and physical resources. However, the phrase ‘digital library’ perhaps deserves to be reconsidered. The purely digital library seems a misguided goal. If we try to replicate an entire, complex information environment, with so many positive affordances, in digital space, we are surely doomed to fail. Rather than trying to replace or reproduce the library, the book or even the notebook, our goal should be to create effective digital resources that can be used in one (a library) or with one (a book or a notebook).

We should also consider another function of the library: to provide a service to others. This was what Cosin was doing, in creating his collection, then making it available. He attempted to use the power of information to effect political and religious change in a troubled time. Digital Humanities has become somewhat nervous of the idea of service, in case it implies that we are not, in some way, a proper discipline. Yet, in future, digital humanities

must address the question of how to balance appropriate service- creating the resources others need and will use- with intellectual adventure- creating exciting, experimental resources that we ourselves need to advance our knowledge.

Just as Cosin's library provided books, a scarce resource, to be read in a pioneering information space, by the few people who had the learning to understand them, so in the early days of DH we made tools to fill the digital void for a few dedicated experts. Despite recent cuts in funding, at least in the UK, libraries are still common; every university has one and we expect all our students to use their resources. The majority of humanities scholars now make use of generic digital tools, even if they are not DH scholars. So what is the role for DH now?

Cosin's experience of exile made him wary of enthusiasts seeking to convert people to their own beliefs. But we have, in DH, sometimes been guilty of evangelising for digital tools and methods, with the implication, or perhaps even the hope, that they might replace traditional scholarly techniques. It is clear now that our role must be far more nuanced. Of course we should still continue to build innovative digital resources and try out new techniques; this is the only way to advance scholarship and create technical innovations. However, rather than trying to replicate a device that is less useful than its physical equivalent, we should, as Galey and Ruecker (2010) argue, value the creation of prototypes as part of the pursuit of pure scholarship that may not immediately, or perhaps ever, be used, but that takes scholarship, and the field, forward. For example, a digital genetic edition

expresses profound views about the nature of the text being edited, but will probably not be used by most scholars and students, who may prefer a simple reading edition (Vanhoutte, 2009). That does not invalidate the work of the editor in creating knowledge, but it does suggest that not everything we make will become widely used, nor should we necessarily design it to be.

If, however, we intend to design resources for the use of others, then the task of digital humanities should be to provide a genuine service to users by taking their views and choices seriously, then producing resources that support the work they wish to do, in the environment they want to use. But we must also consider how the decisions we take when providing, curating and arranging a digital resource can affect those who use it. The arrangement and design as well as content and presentation of a digital resource may not only articulate an intellectual argument, but affect a broader intellectual discourse. As librarians are well aware, when they develop collections, the decisions we make as information providers will touch the lives of users, so must be made with care.

Conclusion

However exciting and challenging the digital world may be, the physical environment and the way it is used is highly complex and deserving of our respect. Our users understand, seemingly quite naturally, the difference between the two, and how they mix and complement each other. The more research that emerges about the way the brain processes digital and physical information and environments, the more this apparently instinctive choice appears to be supported by scientific evidence.

Nevertheless, as digital humanities scholars we have a great deal more to learn about the significance of space, place, pleasure, and multi-sensory input. Although digital resources do not replace, but augment, physical ones, we are still some way from understanding how users make choices about the resources and information spaces that they use. This is driven in many cases by convenience, but it is also, evidently, a more complex issue related to affect and sensory input. Web design and HCI have, quite properly, been overwhelmingly concerned with making digital resources easier to use. But they have neglected the complex question of what disposes a user to enjoy a certain kind of experience. This seems somewhat perverse: in many areas of life humans, just like other animals, are predisposed to favour things that cause pleasure or make them feel comfortable, such as food that tastes sweet, or a warm, light room. We make such choices because our brains make us feel rewarded for doing so (Berridge and Kringelbach, 2015). Why is it, then, that designers of digital humanities resources seem oblivious to this profoundly human drive?

Evidently a digital resource is constrained by the limits of screen size, especially now that it must be designed for use on tablets. However, it was not beyond the ingenuity of the designers of early printed books to produce layouts that were pleasant and usable, but that also introduced devices to help users orientate themselves in a relatively tight physical space of the printed page. In doing so, they also produced objects that were aesthetically pleasing, and that still appeal to the emotions of users. The problem for contemporary designers of digital resources is that it is not clear exactly how

our analogue predecessors achieved this effect. We know that an early printed book has a huge affective appeal to users, and we know that it may contain interesting design features; yet even eminent book scholars such as McKenzie do not make explicit links between features of design and affective responses. Scholars of library design can describe what a space looks like, how it contains light, or leads the user through the space, they can even explain what goes wrong in terms of library design (Schlipf, 2011). But they do not explain the link between a particular combination of features and the sense of wonder or delight that they inspire in users. In other words we know that many people love books and libraries and don't love digital texts and interfaces but as yet we understand very little about why this might be and exactly how this emotional response is linked to physical features of such environments.

If we are to take up the challenge of designing resources that are beautiful, appealing, and useful, we need to advance beyond the traditions of book scholarship, library design, or even of HCI. It is not enough to be able to list the features on a page that make it interesting to a scholar. It is not enough to understand how a library is designed to be as light as possible. It is not enough to know what a user finds comprehensible about an interface. Furthermore we cannot assume that user behaviour in a physical environment will inevitably predict their choices and behaviours in a digital one, because, increasingly, cognitive science suggests that the brain does not regard them as the same. What is missing in user studies is a connection between features or behaviours and the reasons for them. If user behaviour is driven

by not only by cognition but also by emotion, then that is what we have to study. Until we understand why people love being in a certain kind of space, we will never know why they choose to go there, which means we have to find a way not only of listing features but of knowing exactly what the link is between a certain feature, a behavioural choice, the nature of the sensory input involved and the emotions that it engenders, or fails to engender.

This will not be easy, but it is a challenge that very properly belongs to digital humanities. Perhaps only in DH would we feel it is acceptable to apply poetry to digital system design. But our future task might plausibly be encapsulated in the conclusion to Keats' 'Ode on a Grecian Urn', in which he attempts to comprehend the meaning of what we would now describe as a museum object (and might already have digitised):

> When old age shall this generation waste,
> Thou shalt remain, in midst of other woe
> Than ours, a friend to man, to whom thou say'st,
> "Beauty is truth, truth beauty,—that is all
> Ye know on earth, and all ye need to know."
>
> John Keats, Ode on a Grecian Urn, ll. 46-50

Our task is therefore to link the truth of design features to the beauty that results from them. It is to seek to understand something that is profoundly human: how we experience the world emotionally, and what we find aesthetically pleasing. It is then to address the technical problem of how best to create digital resources that are not only usable, but enjoyable, beautiful, and memorable. As such it represents a powerful combination of the digital and the human, what we touch and what touches us. It links the past of the printed book and the library with the future of digital devices and system. It is

one of the most difficult but exciting challenges for the future of digital humanities research.

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[2] McKitterick (2014), for example, talks about the Wren library as being a pioneering collection, and Gwynn (2011) discusses the innovative nature of Ham House library, but neither admits that Cosin's library predates both and is more innovative. Newman (2014) does not discuss Cosin's library at all.